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AVIATION SAFETY

Efforts to Implement Flight Operational Quality Assurance Programs

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The Honorable Wendell H. Ford
The Honorable Ron Wyden
United States Senate

The analysis of aircraft data recorded during flight has played a crucial role in determining the causes of crashes. Recently, however, some U.S. airlines have begun to analyze flight data from uneventful airline flights to identify potential problems and correct them before they lead to accidents. In your letter of December 2, 1996, you asked us to examine efforts by the Federal Aviation Administration (FAA) and U.S. airlines to implement Flight Operational Quality Assurance (FOQA) programs. The objective of a FOQA program is to use flight data to detect technical flaws, unsafe practices, or conditions outside of desired operating procedures early enough to allow timely intervention to avert accidents or incidents. These programs are voluntary efforts by airlines that involve equipping aircraft with specialized devices to continuously record up to hundreds of different flight data parameters from aircraft systems and sensors, analyzing the data, identifying trends, and taking action to correct potential problems. The analysis of flight data allows airlines to reconstruct entire flights on the basis of the values over time of flight data parameters, such as heading, altitude, throttle settings, ground speed, and many others. Currently, about 33 foreign airlines and 4 U.S. airlines—United, US Airways, Continental, and Alaska—have implemented FOQA or FOQA-type programs.

You requested that we determine (1) how FOQA programs will enhance aviation safety, (2) the costs and benefits of such programs, and (3) the factors that could impede their full implementation and actions that could be taken to overcome any impediments.

Results in Brief

The early experience of domestic airlines with established Flight Operational Quality Assurance programs, as well as the testimony of foreign airlines with extensive experience in this area, attests to the potential of such programs to enhance aviation safety by identifying possible safety problems that could lead to accidents. Airlines have used Flight Operational Quality Assurance programs to identify potential problems that were previously unknown or only suspected. Where potential problems were already known, airlines have used these programs to confirm and quantify the extent of the problems. And most

important, on the basis of analyses of flight data, airlines have taken actions to correct problems and enhance aviation safety.

The costs associated with implementing a Flight Operational Quality Assurance program depend upon a large number of factors, including the technology used to capture flight data, the number and types of aircraft to be equipped with this technology, and personnel costs. Although the program is primarily viewed as a safety program, U.S. and foreign airlines have reported financial benefits as well. With additional data on aircraft systems and engine conditions, airlines are better able to achieve optimum fuel consumption and avoid unneeded engine maintenance. Although more difficult to quantify, enhanced safety should result in lower costs over time as a result of accidents avoided and lower insurance premiums. FAA's preliminary estimates place the annual cost of a program with 50 aircraft at approximately $760,000. Savings from reduced expenditures for fuel, engine maintenance, and accident costs for a 50-aircraft program are estimated at $1.65 million per year. FAA's estimates suggest a net savings from 50 aircraft of $892,000 per year.

The primary factor impeding the implementation of Flight Operational Quality Assurance programs among the major domestic carriers is the resolution of data protection issues. Airline managers and pilots raise three significant data protection concerns: (1) use of the data for enforcement/disciplinary purposes; (2) disclosure to the media and the public under the provisions of the Freedom of Information Act; and (3) disclosure through the civil litigation discovery process. FAA has taken a number of actions that may resolve these issues, although it is not clear whether the aviation community will be satisfied with FAA's actions. First, FAA has begun work on a rulemaking procedure to establish what protections from enforcement actions, if any, will apply to information submitted to FAA under a Flight Operational Quality Assurance program. Second, on October 9, 1996, the Congress enacted legislation and FAA has begun work on a rulemaking procedure that would prohibit the Administrator from disclosing voluntarily submitted safety information under certain circumstances. These actions may ameliorate concerns about the Freedom of Information Act. And third, airlines currently seek to protect voluntarily collected safety information from disclosure in civil litigation on a case-by-case basis.

Background

Modern commercial aircraft contain sophisticated electronic systems that gather, process, and manage digital data on many aspects of flight. These

data originate from various systems and sensors throughout the aircraft. The data range from pilot operations to the outputs of sensors and systems. Some of these data are continuously recorded by the aircraft's digital flight data recorder to help investigators understand what happened if the aircraft is involved in an accident or a serious incident.[1] Designed to survive crashes, flight data recorders typically retain the data recorded during the last 25 hours of flight.

Rather than analyzing flight data only after an incident or accident, some airlines routinely analyze the flight data from regular flights. Their aim is to identify problems that occur in routine operations and to correct these problems before they become accidents or incidents. In its 1992 study for FAA,[2] the Flight Safety Foundation coined the term "Flight Operational Quality Assurance" to describe this function. The Foundation defined FOQA as "a program for obtaining and analyzing data recorded in flight to improve flight crew performance, air carrier training programs and operating procedures, air traffic control procedures, airport maintenance and design, and aircraft operations and design."

FOQA has its origin in the use of flight data recorders[3] as mandated by the Civil Aeronautics Administration in 1958. Although the first flight data recorders captured only six parameters,[4] they were a valuable tool for reconstructing what had occurred preceding a crash. In addition to recording data to assist in crash investigations, some airlines began to monitor data recorded on routine flights. Initially, the monitoring systems captured airworthiness data, but over time they have expanded to include operational data. FOQA programs were first established in Europe and Asia, and only within the past few years have some U.S. airlines begun adopting such a system on a trial basis. At present, about 33 foreign airlines and 4 U.S. airlines—United, US Airways, Continental, and Alaska—have implemented FOQA or FOQA-type programs. (See app. I for more detailed background information on FOQA and U.S. airlines' experience with these programs; see app. II for a list of airlines worldwide that have implemented FOQA programs.)

[1]The National Transportation Safety Board, the official source of information on airline accidents, defines accidents as events in which individuals are killed or suffer serious injury, or the aircraft is substantially damaged. Incidents are defined as occurrences other than accidents associated with the operation of an aircraft that affect or could affect the safety of operations. 49 C.F.R. 830.2.

[2]Flight Safety Foundation, Air Carrier Voluntary Flight Operational Quality Assurance Program (1992).

[3]The flight data recorder is commonly referred to as the "black box."

[4]The six required parameters were time, airspeed, heading, altitude, vertical acceleration, and time of radio transmission.

As part of FAA's strategy to achieve significant reductions in aviation accident rates despite the rapid increase in air travel anticipated over the next decade, in 1995 the agency initiated a FOQA demonstration project to promote the voluntary implementation of FOQA programs by U.S. airlines. The objective of such a program is to use flight data to detect technical flaws, unsafe practices, or conditions outside of desired operating procedures early enough to allow timely intervention to avert accidents or incidents. For example, identifying repeated instances of unstabilized approaches to a particular airport could help to define a new approach pattern less likely to lead to an accident under adverse conditions, or to improved pilot training. Such a system has potentially broad application to flight crews' performance and training, aircraft operating procedures, air traffic control procedures, aircraft maintenance, and airport design and maintenance. Major airlines in Europe and Asia, as well as the U.S. airlines that have FOQA programs, are uniform in their support of the program.

How FOQA Works. FOQA involves (1) capturing and analyzing flight data to determine if the pilot, the aircraft's systems, or the aircraft itself deviated from typical operating norms; (2) identifying trends; and (3) taking action to correct potential problems. Airlines with FOQA programs typically use a device called a quick access recorder to capture flight data onto a removable optical disk that facilitates the data's frequent removal from the aircraft.[5] Periodically, the optical disks are removed from the aircraft, and the flight data are analyzed by the ground analysis system at a centralized location. The data are analyzed by a computer system that evaluates about 40 to 80 predefined events for deviations from the airline's specified tolerance thresholds. For example, an event might be the descent rate during approach. Deviations of more than certain predetermined values, called "exceedances," are flagged and evaluated by a monitoring team. After investigating these exceedances to determine their validity and analyzing them to understand possible causes, the monitoring team will propose and evaluate corrective actions. Periodically, airlines aggregate exceedances over time to determine and monitor trends. (For a more complete discussion of FOQA operations, see app. I.)

The FOQA Demonstration Project. In July 1995, FAA initiated a 3-year, $5.5 million demonstration project to facilitate the start-up of voluntary airline FOQA programs and to assess the costs, benefits, and safety enhancement associated with such programs. FAA provided hardware and software to each of the three airlines—United, US Airways, and

[5]These data typically include the parameters required to be collected on the aircraft's flight data recorder plus many more parameters. See app. I for more information on quick access recorders and flight data recorders.

Continental—that have implemented FOQA programs according to the demonstration project's requirements. FAA purchased quick access recorders to equip 15 Boeing 737 aircraft at each of the three airlines. FAA also purchased a ground analysis system—the computer hardware and software for analyzing and visualizing FOQA data—for US Airways and Continental. Because United already had purchased a ground analysis system that analyzes these data for other types of aircraft, FAA purchased for the airline the additional software needed to analyze FOQA data from 737s. For their part, these airlines funded the cost of obtaining supplemental type certification[6] of the airborne equipment, the costs of installation and maintenance, and the cost of personnel to run and monitor the program. Alaska Airlines is the fourth U.S. airline to have begun a FOQA program, but it has only recently met the demonstration project's requirement for an agreement on FOQA by the airline's pilot union. Consequently, the project has not yet provided any equipment to the airline. Alaska Airlines, however, received quick access recorders and a ground analysis system from the FAA Structural Loads Program and uses this equipment to operate its FOQA program. (See app. III for more information on the Structural Loads Program.) Other airlines that are participating in the demonstration project and are considering the implementation of a FOQA program are America West, Delta, Northwest, Trans World, Southwest, Continental Express, and United Parcel Service.[7] (See app. I for a detailed description of the FAA demonstration project.) As a research and development effort of the FOQA initiative, FAA is developing the Aviation Performance Measuring System, an advanced system for conducting automated analysis and research on FOQA data. (See app. III for a description of this system and FAA's other related technical programs.)

Rather than requiring airlines to implement FOQA, FAA has chosen to promote the initiative through a cooperative demonstration project in partnership with the industry. According to the demonstration project's program manager, it would be premature for FAA to mandate FOQA at this time because U.S. aviation is still in the early stages of developing FOQA and is primarily in a learning mode. The program manager contends that a mandated program would stifle innovation, encounter substantial resistance from airlines and pilots, and most likely result in minimal compliance. Thus, at present, FAA is working with the industry to raise interest in the concept, facilitate the design and implementation of

[6]An FAA type certificate is issued when an aircraft, aircraft engine, propeller, or appliance is properly designed and manufactured, performs properly, and meets the regulations and minimum standards prescribed by the Administrator. An FAA supplemental type certificate is required when there is a change to an aircraft, aircraft engine, propeller, or appliance. 49 U.S.C. 44704.

[7]Although not a participant in the demonstration project, American Airlines is considering the implementation of an internal FOQA-type program.

voluntary FOQA programs, provide financial and technical assistance, and foster innovation.

FOQA Identifies Potential Safety Problems

The primary characteristic that distinguishes FOQA from other safety reporting programs, such as the Aviation Safety Reporting Program or Aviation Safety Action Programs,[8] is that FOQA provides objective, quantitative data on what occurs during flights rather than what is subjectively reported by individuals. Instead of needing to rely on perceived problems or risks, FOQA yields precise information on many aspects of flight operations, and this information can be used to help objectively evaluate a wide range of safety-related issues.

U.S. and foreign airlines have reported on previously unknown or suspected problems for which FOQA has provided objective information that resulted in corrective actions. One airline found through its FOQA program that more exceedances occurred during visual flying than during instrument flying. This finding prompted the airline's flight-training managers to rethink the relative emphasis given visual and instrument flying in the airline's training programs. Another airline's FOQA analysis confirmed that the incidence of descent rate exceedances during approaches was significantly higher at a particular runway at a U.S. airport than at other runways. After investigating the problem, the airline concluded that the air traffic control approach had been set too high, requiring pilots to descend more steeply than usual during their final approach. When the airline shared its findings with FAA management, the approach was modified to correct this potential problem.

For landings, some airports' air traffic control procedures require pilots to approach high and fast and then descend steeply. These approaches can result from a number of factors, including noise abatement rules, traffic volume, terrain, or weather conditions. Although airline managers know about the situations from pilots' reports, FOQA gives them the quantitative information to demonstrate the extent of this problem at the various airports. With these data in hand, managers can be more effective in addressing the problem and taking action to mitigate or eliminate risks.

FOQA can also help airlines determine the frequency of certain occurrences rather than having to rely on human judgment, particularly for the level of maintenance required. Two examples of these types of occurrences are hard landings and exceedances in engine temperatures. Prior to FOQA,

[8]See app. IV for a description of these programs.

airlines generally relied on pilots' judgment of the necessity for corrective action if a hard landing occurred or an engine overheated. FOQA, however, can provide better information on the amount of force the aircraft experienced during a hard landing. Similarly, FOQA gives more data on the engines' temperatures and the duration of overheating in some aircraft than were previously available without FOQA. With these data, managers can make more informed decisions about whether the aircraft needs to be inspected to check for structural damage or whether an engine needs to be overhauled.

U.S. and foreign airlines have reported that they have used FOQA analysis to identify a variety of potential safety problems and take corrective action to resolve or mitigate them. These have included steep takeoffs, which can damage the aircraft's tail; approaches that are outside the prescribed procedures for a "stabilized" approach; descent rates or bank angles that are considered excessive; high taxi speeds; hard landings; wind shear occurrences; ground proximity warnings; and engine malfunctions. Corrective action can include notifying pilots of a change in standard operating procedures or restating and emphasizing them, correcting an equipment problem, or providing additional training. The continued monitoring of trends will tell the airline if the corrective action has been effective or whether additional measures are needed.

A number of airlines plan to complement the use of FOQA data with information from safety reporting systems, such as Aviation Safety Action Programs or internal pilot reporting systems. FOQA data, originating from aircraft sensors and systems, tell "what" happened to the aircraft. Internal safety reporting systems, based on reports of pilots, flight crews, and other persons, are more likely to tell "why" something happened. Together, information from FOQA and internal reporting systems can provide valuable insight into current and emerging problems.

FOQA's Potential Costs and Benefits

Based on preliminary estimates from an ongoing cost-benefit study by Universal Technical Resource Services, Inc. (UTRS), an FAA contractor, table 1 summarizes the estimated annual costs for airlines to equip 15, 50, and 100 aircraft with quick access recorders, purchase a ground analysis system, and pay FOQA-related salaries.[9]

[9]Because FAA's cost-benefit study is in progress, we were not able to verify FAA's estimates of FOQA costs and savings. The cost and savings figures are preliminary and may change as more data are gathered.

Table 1: Estimated Total Annual Costs, by Fleet Size

	15 aircraft	50 aircraft	100 aircraft
Equipment costs	$98,500	$259,000	$492,000
Personnel costs	385,000	500,000	775,000
Total annual costs	**$483,500**	**$759,000**	**$1,267,000**

Note: Equipment costs are based on the invoice price paid to vendors in the FOQA demonstration project. To annualize the figures, the equipment purchase costs have been spread over a 5-year period. Personnel costs are based primarily on estimates of FOQA management, analysis, monitoring, and engineering costs from an airline participating in the demonstration project.

Source: UTRS.

The cost-benefit study estimates that airlines will reduce their expenditures for fuel and maintenance as well as reduce the number of accidents and incidents over time, avoiding their associated costs. Because FOQA programs analyze additional data on aircraft systems and engine conditions, airlines are better able to achieve optimum fuel consumption and avoid unneeded engine maintenance. Although more difficult to quantify and directly relate to a FOQA program, enhanced safety should result in lower costs over time as a result of accidents avoided and lower insurance premiums. Table 2 summarizes the estimated annual savings for fleet sizes of 15, 50, and 100 aircraft. Fuel savings and engine savings figures are based on estimates of a 0.5-percent reduction in fuel consumption and a 1-percent reduction in engine maintenance costs. The safety savings figure is based on a hypothetical 1-percent reduction in the annual costs incurred from accidents. FAA's contractor based its safety savings calculation on a current loss rate of 2 aircraft per million departures at a cost of $150 million for each loss.

Table 2: Estimated Total Annual Savings, by Fleet Size

	15 aircraft	50 aircraft	100 aircraft
Fuel savings	$145,800	$486,000	$972,000
Engine savings	300,000	1,000,000	2,000,000
Safety Savings	49,500	165,000	330,000
Total annual savings	**$495,300**	**$1,651,000**	**$3,302,000**

Note: Fuel and engine savings were estimated on the basis of discussions with an airline participating in the FOQA demonstration project. Safety savings were estimated on the basis of information from a European airline with a long-term FOQA program. Savings estimates were also based on an assumption of 3,000 flight hours per aircraft per year.

Source: UTRS.

According to these annual cost and savings estimates, FOQA would result in net annual savings of $11,800 for 15 aircraft, $892,000 for 50 aircraft, and $2,035,000 for 100 aircraft. See table 3.

Table 3: Estimated Net Annual Savings, by Fleet Size

	15 aircraft	50 aircraft	100 aircraft
Total annual costs	$483,500	$759,000	$1,267,000
Total annual savings	495,300	1,651,000	3,302,000
Net annual savings	**$11,800**	**$892,000**	**$2,035,000**

Source: UTRS.

Factors Impeding Implementation and Actions to Overcome Impediments

Although airline officials, pilot organizations, and FAA officials recognize the potential for improving safety and operations through FOQA programs, airline officials and representatives of the pilot organizations were unanimous in their view that data protection issues need to be resolved. Both airline officials and pilots' representatives stated that the lack of protections for FOQA data has been a major contributor to pilot unions' reluctance to sign FOQA agreements with airlines and airlines' reluctance to implement FOQA programs.

According to the Flight Safety Foundation's 1992 report, the greatest impediment to the implementation of FOQA in the United States is associated with the "protection of data from use for other than safety and operational improvement purposes." Basically, airline managers and pilots have three concerns: (1) that the information may be used in enforcement/discipline actions, (2) that such data in the possession of the federal government may be obtained by the public and the media through

the provisions of the Freedom of Information Act (FOIA), and (3) that the information may be obtained in civil litigation through the discovery process. Similar concerns have been expressed in connection with other programs under which information is submitted voluntarily to FAA.

Enforcement

Representatives from each of the major airlines as well as the unions that represent pilots from the major airlines—the Air Line Pilots Association, the Allied Pilots Association, the Independent Association of Continental Pilots, and the Southwest Airlines Pilot Association—told us that the airlines and pilots fear the possibility that FOQA data might be used against them in FAA enforcement proceedings. In addition to these concerns, pilots' representatives were concerned that airline managers could use FOQA data to punish or discipline pilots.

FAA Enforcement. Many U.S. airlines and their pilots appear frustrated with FAA's delay in issuing a regulation implementing the nonenforcement policy articulated in a February 1995 policy letter from the Administrator to the Air Line Pilots Association and the Air Transport Association. FAA's letter said that no enforcement action will be taken on the basis of the information gained through FOQA. Specifically the letter stated:

> "The FAA commits that it will not use information collected by a carrier in an FOQA program to undertake any certificate or other enforcement action against an air carrier participating in such a program or one of its individual employees. Notwithstanding, the FAA reserves its rights to use, for any other purpose, information obtained from sources other than FOQA, including flight-recorder parameters specifically required by the Federal Aviation Regulations. The limitation on the use of information applies only to information collected specifically in an FOQA program."

In an April 1997 letter to the Air Transport Association's FOQA Steering Committee, the Director of FAA's Flight Standards Service said that the 1995 policy letter will remain in effect until the regulation on enforcement is issued. The letter stated that a proposed rulemaking setting forth FAA's enforcement protection policy should be ready by the end of 1997.

According to airline officials and a pilot union's representative, FAA's delay in promulgating an enforcement regulation has hampered efforts to reach agreement with some pilot unions and threatens the continuance of agreements already reached. One of the issues facing FAA is how broad the enforcement protection should be. FAA attorneys have concluded that it is beyond the scope of FAA's authority and in violation of its statutory duties

to issue a regulation that precludes the agency from taking action if FOQA data reveal that an airplane was not in a condition for safe flight or that a pilot lacked qualifications. Pilots' representatives, however, have cited the precedent of FAA's cockpit voice recorder regulation that prohibits the agency from using the record in enforcement actions without exceptions.[10]

FAA officials told us that the agency is trying to find the proper balance between carrying out its enforcement responsibilities and providing incentives for implementing safety programs and sharing information with FAA. In similar programs, such as the Aviation Safety Reporting Program, Air Carrier Voluntary Disclosure Reporting Procedures, and Aviation Safety Action Programs,[11] under which safety information is voluntarily submitted, the agency has a policy of addressing alleged violations through administrative actions or forgoing and/or waiving the imposition of any legal enforcement if certain qualifying criteria are met. These programs are intended to encourage prompt reporting of violations, sharing of important safety information, and pilot training to enhance future compliance. While the qualifying criteria differ for each program, these programs exclude actions that are deliberate or demonstrate or raise questions of qualifications. Generally, the parameters of the programs, including the qualifying criteria, are spelled out in the governing advisory circular. It is FAA's belief that by offering incentives, such as forgoing legal enforcement actions under certain conditions, more problems may be reported and ultimately corrected than could be discovered through other means, such as inspections.

Airline Enforcement. Airline managers are working with their respective pilot unions to enter into data-use agreements that include individual protection provisions. According to the Flight Safety Foundation study, data-use agreements with pilot associations have existed since flight data recorders were first required in the late 1950s. Having such an agreement is a precursor to becoming a full partner in the FOQA demonstration project. Generally, these agreements provide, among other things, the company's assurance not to use the recorded flight data for punitive or

[10]The cockpit voice recorder regulation provides that: "The Administrator does not use the cockpit voice recorder record in any civil penalty or certificate action." 14 C.F.R. 91.609(g). FAA's regulations also provide enforcement protection with some qualifications to information collected under the Aviation Safety Reporting Program. Specifically, the regulation provides that "The Administrator of the FAA will not use reports submitted to the National Aeronautics and Space Administration under the Aviation Safety Reporting Program (or information derived therefrom) in any enforcement action except information concerning accidents or criminal offenses which are wholly excluded from the Program." 14 C.F.R. 91.25.

[11]See app. IV for a description of these programs.

disciplinary action against a crew member, or as evidence in any proceeding. Also, to ensure the protection of the company's employees, the data-use agreements generally provide for the de-identification of the information as soon as possible, usually within 7 days. This practice ensures the confidentiality and anonymity of the flight crew members participating in the program.

Freedom of Information Act Requests

Both airlines and pilots are concerned that FOQA data could become public and available to the media through the federal FOIA, if such data are provided directly to FAA.[12] The federal FOIA sets forth a policy of broad disclosure of government documents to ensure "an informed citizenry, vital to the functioning of a democratic society." NLRB v. Robbins Tire & Rubber Co., 437 U.S. 214, 242 (1978). The Congress understood, however, that "legitimate governmental and private interest could be harmed by release of certain types of information." FBI v. Abramson, 456 U.S. 615, 621 (1982). Accordingly, the act provides for nine categorical exemptions.

In the past, safety information voluntarily submitted to FAA, for example under Air Carrier Voluntary Disclosure Reporting Procedures, has been protected under exemption 4 of FOIA. Exemption 4 protects trade secrets and commercial or financial information obtained from a person that is privileged or confidential. Airline officials and pilots' representatives expressed concern that FOQA data may not be protectable under this exemption.

Recently, the Congress enacted the Federal Aviation Reauthorization Act of 1996, which contains a provision that protects voluntarily submitted information under certain circumstances. Specifically, under the provision, notwithstanding any other provision of law, the Administrator is barred from disclosing voluntarily provided safety- or security-related information if the Administrator finds that

> "(1) the disclosure of the information would inhibit the voluntary provision of that type of information and that the receipt of that type of information aids in fulfilling the Administrator's safety and security responsibilities; and (2) withholding such information from disclosure would be consistent with the Administrator's safety and security responsibilities." 49 U.S.C. 40123.[13]

[12]Currently, airlines provide no FOQA data to FAA. Rather, FAA reviews aggregated trend information on the airlines' premises.

[13]A similar provision was included in the National Transportation Safety Board Amendments of 1996 to protect information that is voluntarily submitted to the Board.

The provision also requires the Administrator to issue regulations to implement the section.

The House report accompanying this legislation noted with approval the data-sharing programs such as FOQA and the Committee's intent to encourage and promote these sorts of innovative safety programs. The report provides that information submitted under these programs would arguably be protected from release under exemption 4 of FOIA; however, the report notes that such a decision to withhold the information would be discretionary with the agency. The report states that to provide assurance that such information is not publicly released, the legislation would prohibit FAA from disclosing voluntarily submitted safety information. According to the report, this protection should "alleviate the aviation community's concerns and allow the data-sharing safety programs to move forward." Moreover, the report noted that the provision would not reduce the information available to the public, since the public does not receive the data. Rather, the report states that public safety will be enhanced by the increase in FAA's understanding of ongoing trends in operations and technologies.[14]

FAA is currently working on a rulemaking procedure that will prohibit the release of voluntarily submitted safety data through FOIA.[15] It is expected that the rulemaking will provide the procedures that the agency will use in making the required determinations. It is also expected that FOQA data will be proposed as qualifying for the protection. According to an FAA attorney, the determinations for the FOQA program may be included in the notice of proposed rulemaking on the FOQA nonenforcement policy. The anticipated FOIA rulemaking and the subsequent findings to include the FOQA program within the protection should help mitigate or resolve the industry's fears about the possible disclosure of FOQA data through FOIA requests if FOQA data are provided directly to FAA.

Discovery Process in Civil Litigation

Some airline officials have told us that although they want to improve aviation safety by implementing a FOQA program, the voluntary collection

[14]H.R. Rep. No. 104-714 pt. 1 at pp. 40-41 (1996).

[15]In the Final Report of the White House Commission on Aviation Safety and Security, dated Feb. 12, 1997, a recommendation was made that FAA should work with the aviation community to develop and protect the integrity of standard safety databases that can be shared in accident prevention programs. The report stated that FAA needed to expeditiously complete rulemaking to implement the voluntary disclosure protection provision and that the agency should assess the adequacy of the new legislative authority and implementing regulation 1 year after the regulations take effect. The report further stated that any necessary regulatory or legislative modifications identified at that time should be promptly addressed.

of data may potentially expose airlines to greater liability in civil litigation. FOQA data may indicate conditions outside of desired operating procedures. Airline officials and pilot representatives told us that they are concerned that through broad discovery rules, FOQA data could be inappropriately used or disclosed to the public. The general purpose of discovery is to remove surprise from trial preparation so that parties may obtain the evidence necessary to evaluate and resolve their dispute.[16] Since FOQA data are retained at the airlines and are not currently provided directly to FAA, the focus has been on the airlines' ability to protect the information.

Under federal rules, parties in litigation in federal court are authorized to obtain discovery of any matter, not privileged, which is relevant to the subject matter involved in the pending action, whether it relates to the claim or defense of the party seeking discovery or to the claim or defense of any other party. Generally, privileges are narrowly construed and in some cases are qualified. However, even in the absence of a privilege, a district court has broad discretion under the federal rules to issue an order to protect a person from annoyance, embarrassment, oppression, or undue burden or expense if there is a good cause for issuance of the order. Courts generally invoke a balancing test to decide when a protective order is appropriate and how it is to be applied.[17]

In two recent cases, the airlines have tried to convince federal courts that voluntarily collected safety data similar to FOQA data should be protected from discovery or, at the very least, covered under a protective order.[18] In both cases, the courts sought to achieve a balance between the airlines' desire to protect the information and the plaintiffs' right to a fair trial. In the first case, the court rejected a claim that the information should be protected under the self-critical evaluation privilege but limited the possible uses of the documents it ordered to be produced.[19] This determination was effected through a protective order. In the other case,

[16]6 Moore's Federal Practice, section 26.02 (Matthew-Bender 3d ed.).

[17]6 Moore's Federal Practice, ch. 26 (Matthew-Bender 3d ed.).

[18]Court Order of Oct. 26, 1995, In re: Air Crash at Charlotte, North Carolina, on July 2, 1994, MDL Docket No. 1041 (D.S.C. 1995) (the court rejected the claim of self-critical evaluation privilege); but see, Court Order of Nov. 14, 1995, In re: Air Crash at Charlotte, North Carolina, on July 2 1994, MDL Docket No. 1041 (D.S.C. 1995) (the court issued a protective order); and In re: Air Crash Near Cali, Columbia, on Dec. 20, 1995, 959 F. Supp. 1529 (S.D. Fla. 1997) (the court rejected the claim of self-critical evaluation privilege but recognized a new qualified privilege for the American Airlines Safety Action Program). For a more detailed discussion of these court cases, see app. V.

[19]The self-critical evaluation privilege, when recognized, protects documents that reflect an internal self-analysis.

the court also rejected the claim of self-critical evaluation privilege but at the same time recognized a new qualified privilege for information collected under a partnership program with FAA, the American Airlines Safety Action Program.[20]

Although airlines are generally pleased with the court's decision to grant a qualified privilege to Aviation Safety Action Program materials, it is not clear whether other courts will recognize this new privilege or extend it to other safety and security information that has been voluntarily collected. Nor is there a guarantee that FOQA data or other similar information, if found not to be privileged, would be covered under a protective order. However, we found no instances to date in which FOQA data have been subject to a discovery request. This situation may result from the fact that airlines are just beginning to institute FOQA programs. However, some of the pilot union officials we spoke with noted that discovery is a concern because of the potentially large amounts of data that will be collected. While some in the aviation community believe that one way to ensure protection would be through legislation, there does not appear to be a consensus to seek legislation at this time.[21] Concern has been expressed that the failure of a legislative effort may adversely affect how courts treat voluntarily collected safety information.

In the event that FAA does receive FOQA data directly, according to FAA attorneys, it has provisions in place for dealing with requests from private litigants for documents in the agency's possession. FAA attorneys noted that a request for records from a private litigant, when the agency is not a party to the action, will generally be treated as a FOIA request (see 49 C.F.R. 9.13). If the agency is a party to the litigation, FAA will seek to protect the information, if appropriate, under a claim of government privilege and, if that fails, to release the information under a protective order.

Agency Comments

We provided copies of a draft of this report to the Department of Transportation and FAA for their review and comment. We met with officials, including FAA's Deputy Associate Administrator for Regulation and Certification and the demonstration project's program manager. They

[20]Thus, the court provided that the plaintiff could come forward with a persuasive showing of need and hardship. In such case, the court would review the voluntarily collected information in camera and evaluate whether the plaintiff's interests overcome the powerful interest that weighs in favor of preserving the confidentiality of the information. No such showing was made in this case.

[21]Limited legislative protection has been provided for cockpit voice recorders, 49 U.S.C. 1154.

agreed with the report and provided several technical corrections, which were incorporated into the report.

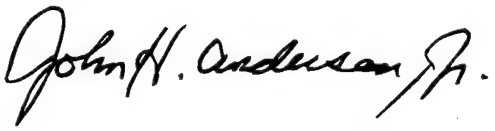
Scope and Methodology

To obtain the information in this report, we reviewed FAA's FOQA demonstration project's requirements, policies, and plans to assist airlines in implementing FOQA programs. We discussed specific details of the project with FAA's Deputy Associate Administrator for Regulation and Certification as well as the demonstration project's program manager and contractor. We conducted interviews with FAA and National Aeronautics and Space Administration officials responsible for developing the Aviation Performance Measuring System. We discussed FOQA issues with the National Transportation Safety Board. We interviewed representatives of each of the 10 largest passenger airlines: Alaska, America West, American, Continental, Delta, Northwest, Southwest, Trans World, United, and US Airways; representatives of each of the four unions—the Air Line Pilots Association, the Allied Pilots Association, the Independent Association of Continental Pilots, and Southwest Airlines Pilot Association—representing the pilots of these airlines; and United Parcel Service. We also conducted interviews with the Air Transport Association, the Flight Safety Foundation, and the vendors providing hardware and software for the demonstration project. Last, we interviewed and collected information from foreign airlines and Britain's Civil Aviation Authority on their respective FOQA efforts.

We performed our work primarily at FAA headquarters in Washington, D.C., and conducted our evaluation from January through October 1997 in accordance with generally accepted government auditing standards.

As requested, we plan no further distribution of this report until 30 days after the date of this letter unless you publicly announce the report's contents earlier. At that time, we will send copies to the appropriate congressional committees and the Department of Transportation and FAA.

We will also make copies available to others upon request. Please call me at (202) 512-2834 if you have any questions about this report. Major contributors to this report are listed in appendix VI.



John H. Anderson, Jr.
Director, Transportation Issues

Contents

Abbreviations

APMS	Aviation Performance Measuring System
AQP	Advanced Qualification Program
ASAP	Aviation Safety Action Programs
ASRP	Aviation Safety Reporting Program
ASRS	Aviation Safety Reporting System
BA	British Airways
DEMOPROJ	FOQA demonstration project
DFDAU	digital flight data acquisition unit
FAA	Federal Aviation Administration
FAR	Federal Aviation Regulation
FOIA	Freedom of Information Act
FOQA	Flight Operational Quality Assurance
FSF	Flight Safety Foundation
GAIN	Global Analysis and Information Network
KLM	Royal Dutch Airlines
NASA	National Aeronautics and Space Administration
PCMCIA	Personal Computer Memory Card International Association
QAR	quick access recorder
UTRS	Universal Technical Resource Services, Inc.

The FOQA Concept and Its Implementation in the United States

FOQA's Background

Flight Operational Quality Assurance (FOQA) had its origin in the use of flight data recorders as mandated by the Civil Aeronautics Administration in 1958. Although the first flight data recorders captured only six parameters—time, airspeed, heading, altitude, vertical acceleration, and time of radio transmission—they were a valuable tool for reconstructing what had occurred before and during accidents. By the 1960s, airlines had begun to monitor data on routine flights. Initially, the monitoring systems captured airworthiness data, but over time they have expanded to include operational data. In the late 1960s, Trans World Airlines began a program to monitor a limited number of parameters related to approaches and landings as flight data recorders received periodic maintenance.

At least eight foreign airlines have had FOQA-type programs in operation for over 25 years. A program using data from flight data recorders was begun by British Airways (BA) in 1962 to validate airworthiness criteria. Although limited by today's standards, BA's program contained the seeds of a modern, safety-oriented FOQA program. Currently, BA analyzes the flight data from all of the aircraft in its fleet through its Special Events Search and Master Analysis program. Over the years, the number of foreign airlines that have implemented a FOQA-type program has steadily risen. Japan Airlines' FOQA program of over 15 years includes a printer in the cockpit so that pilots can monitor their own performance. All Nippon Airways began a program to analyze flight data in 1974. Other foreign airlines with established FOQA programs include Scandinavian Airlines System, Royal Dutch Airlines (KLM), and Lufthansa. Many of these airlines are convinced that FOQA is a critical component in their safety efforts and that the program has paid valuable safety dividends over the years. Currently, about 33 foreign airlines and 4 U.S. airlines—United, US Airways, Continental, and Alaska—have implemented FOQA programs (see app. II for the complete list).

Recognizing the value of operational flight data and the critical nature of flight crews' performance in accidents, the Flight Safety Foundation (FSF) proposed and was selected by the Federal Aviation Administration (FAA) in 1991 to study FOQA. In its 1992 report on FOQA, FSF said that

> "The proposal was based on FSF's conviction, formed by the positive experiences of its international member airlines using FOQA, that the appropriate use of FOQA data by airlines, pilot associations and aircraft and equipment manufacturers would result in a significant improvement of flight safety by identifying operational irregularities that can foreshadow accidents and incidents."

The FSF study concluded that FOQA must proceed in the United States and that the implementation of FOQA by U.S. airlines would have a more positive impact on Part 121 operational safety than any other human factors program included in FAA's research and development plans. FSF recommended that FAA promote voluntary FOQA programs by instituting a demonstration program in partnership with industry. In 1992, FAA's Flight Standards Service proposed funding for a demonstration program. On February 9, 1995, FAA announced its plans for an FAA-industry demonstration project, and the Administrator sent a policy letter to the Air Transport Association and the Air Line Pilots Association stating that FAA would not use FOQA data for enforcement purposes, provided that the airlines met certain requirements.

How FOQA Works

At a minimum, FOQA involves the analysis of flight data on a routine basis to reveal situations requiring corrective actions before problems occur. To institute such a program, airlines need methods to capture flight data, transform the data into the appropriate format for analysis, and generate reports and visualizations to assist personnel in analyzing the data. Although different methods are available, the following describes how a representative FOQA program operates; the descriptions are based on the experience of the four U.S. airlines that have implemented FOQA.

Management. A typical program is managed and operated by a FOQA manager, one or more analysts, and a FOQA monitoring team (sometimes referred to as the exceedance guidance team) made up of airline pilots who work on FOQA on a part-time basis. Generally, the majority of the monitoring team's pilots are also representatives of the pilot union. These individuals manage the FOQA program in strict adherence to the agreements made with the pilot union, most notably on ensuring the confidentiality of pilots' identities. This group is responsible for defining and refining exceedances and parameters, reviewing and analyzing data, and determining and monitoring corrective actions.

Data capture. The first step is the capture of data over the duration of the flight. Flight data comprise snapshots of values or measurements from various aircraft systems. Each data item represents information from a discrete source, such as an instrument or sensor. Generally, these data items are referred to as "parameters." Examples of parameters are "altitude" or "landing gear position." Recording rates vary, depending on the parameter, ranging from many times per second to about once per minute.

Although flight data recorders continuously record, at a minimum, FAA-mandated parameters during every flight, they typically are not designed to provide frequent access to their data but rather to survive the extreme conditions during and after crashes to preserve flight data for accident investigations. These devices are housed in crash-resistant, sealed containers designed to withstand high "g" forces, submersion in water, and fire. Obtaining frequent access to flight data recorders for FOQA purposes, however, would produce increased wear on internal mechanisms and result in shortened mechanical life and increased expense for a very specialized device.[22] Also, flight data recorders may not capture a sufficient number of parameters to be useful for FOQA purposes. Currently, FAA requires from 16 to 29 parameters to be recorded on flight data recorders in transport aircraft;[23] a FOQA program, however, would likely capture many more parameters. Typically, the 200-500 parameters available on modern digital aircraft allow a more comprehensive set of conditions to be monitored. Finally, flight data recorders hold about 25 hours of flight data, a relatively short time period. Instead, some U.S. airlines use a device called a quick access recorder (QAR) to record FOQA data to a removable optical disk or Personal Computer Memory Card International Association (PCMCIA) card.[24] QARs record flight data that are output from the aircraft's digital flight data acquisition unit (DFDAU), the same device that feeds parameters to the flight data recorder. On average, QARs hold from 100 to 200 hours of flight data.

Data transfer. As aircraft receive periodic servicing, the medium (optical disk or PCMCIA card) containing flight data is removed from the QAR and sent to a central location for analysis. A new disk or card is inserted into the QAR for the next round of flights. Airlines retrieve the data on schedules ranging from 3 to 20 days.

An alternative to physical recording media is the use of datalink systems to transmit information directly to the ground-based system, eliminating the need to retrieve data from the aircraft. Two participating airlines are investigating the use of automatic wireless data transfer upon landing at specially equipped airports. Data would be transmitted on a radio

[22]The newer solid-state flight data recorders, however, have no moving parts and would not experience wear problems. Transferring data from these devices takes several minutes to perform.

[23]Under a recently issued rule, FAA requires the recording of 16 to 29 parameters by the flight data recorder on all existing transport aircraft, depending on the aircraft model, its internal systems, and its date of manufacture. Aircraft manufactured after the rule, however, will be required to record 88 parameters within 5 years. 62 Fed. Reg. 38362 (July 17, 1997).

[24]Other airborne data collection systems in use around the world include QARs using tape cartridges and solid-state devices.

frequency link from the aircraft to a receiving station after the aircraft lands. In turn, a local area network would transfer the data to the ground analysis station. Data encryption and other methods would be used to ensure the security of the transmitted FOQA data.

Data processing and analysis. Each airline has a ground analysis system where airborne collected data are processed and analyzed. The ground analysis system transforms the raw digital flight records into usable form for processing, analyzes the flight information, and generates information on any detected exceedances that represent deviations from normal operating practices or exceptional conditions.

The flight data analysis component of the ground analysis system categorizes operational events to be flagged by defining a set of parameters that indicate normal operating envelopes. The associated thresholds for these parameters vary by the type of aircraft and associated operating limits, accepted practices for safe operations, the phase of flight, and the duration of any irregularity. For example, the threshold of selected parameters may be defined for various altitudes, e.g., 1,000, 500, 250, and 100 feet, during landing mode events. Typically, 40 to 80 events are defined and analyzed for a particular aircraft. For example, events might be the ground speed during taxi or the descent rate during approach. The analysis software will track the descent over time to calculate a rate in terms of feet per minute. Depending on the aircraft's altitude, a descent rate in excess of specified thresholds will trigger an exceedance. Various categorization schemes are used to classify the seriousness of the exceedance. U.S. airlines use two or three categories to describe the seriousness of exceedances, ranging from minor deviations to major deviations. Exceedances are typically specified on the basis of a strategy for identifying those that have the greatest potential for safety and performance considerations. Once the initial exceedance categories and associated parameters have been defined and utilized, they are subject to an ongoing evaluation and refinement process.

The ground analysis software also validates the quality and integrity of the collected data and filters out any marginal or transitory irregularities. Ground analysis systems also include protective mechanisms, such as the de-identification of pilot and specific flight information and user access privileges based on assigned passwords. As the data are processed, the flight number and day of the month are removed and saved into a separate controlled file. This step "de-identifies" the FOQA data.

The FOQA monitoring team investigates each exceedance to determine what occurred and the severity of the exceedance. An analyst will review the parameter values surrounding the event and other information to determine if the exceedance was valid or if the exceedance was based on bad data, a faulty sensor, or some other invalidating factor. For example, one flight had excessive rudder input on landing that correctly registered as an exceedance. On closer examination, it was determined that because the aircraft was making a cross-wind landing, the use of large rudder input was justified. In this case, the exceedance was deemed invalid and was removed from the exceedance database.

Depending on the particular circumstances of the exceedance, the pilot association's representative may contact the flight crew to gather more information. After reviewing the situation to determine the exceedance's cause, the FOQA monitoring team and pilot association's representative will determine any necessary corrective action. Corrective action can range from additional flight crew training, to revisions of the operating procedures, to redesigns of equipment.

Trend analysis. On a periodic basis, airlines aggregate and analyze exceedances over time—for example, the number of unstabilized approaches at a particular airport per month, over the last 12 months. This type of analysis provides valuable information to the airline, especially in terms of whether the airline's performance is improving, holding steady, or deteriorating. This look at aggregate exceedances over time provides airline managers with a new perspective on potential problems that would not be visible otherwise. On the basis of the trend analysis, airline managers can take corrective action to reduce or eliminate these exceedances by focusing on the root causes and making or recommending changes.

Data retention. Detailed FOQA data, including exceedances, are destroyed in 30 days or less by three of the four U.S. airlines with FOQA programs. Trend data, however, are kept indefinitely.

Aircraft equipping decisions. The U.S. airlines with active FOQA programs have each equipped a portion of their available fleets with QARS. They began their programs by equipping their more modern, technically advanced aircraft with QARS—late-generation aircraft already contain the sensors and advanced digital systems that acquire and control many more flight data parameters than earlier-generation aircraft. Generally, these airlines do not plan to equip any of their older, analog-based aircraft, such

as Lockheed L-1011, McDonnell Douglas DC-9 and DC-10, and Boeing 727, 737-100, and 737-200, with QARs to record flight data because these aircraft would be expensive to retrofit and because the airlines plan to retire many of them in the near future.

Several U.S. airlines plan to equip all new aircraft with QARs or other technology to capture FOQA data. Some new aircraft, for example, are delivered with QARs as standard equipment. Airlines cited several advantages in having new aircraft delivered with factory-equipped QARs. One advantage is that aircraft are not taken out of service to be retrofitted with equipment. Another advantage is that the additional cost of a QAR can be spread over the finance period of the new aircraft.

Depending on the specific goals of a FOQA program, an airline may wish to equip some or all of its fleet to collect flight data. If a program's goal is to identify broad trends in flight operations and safety, the airline may choose to equip only a portion of its fleet. If a program's goal, however, is to more closely monitor the flight operations and performance of individual aircraft, the airline may want to equip more or all of its fleet. For an airline that begins by equipping only a portion of its fleet, more aircraft will likely be added to the program so that these data can be monitored as its FOQA program matures and efficiency and maintenance functions are added to the program. Some U.S. airlines, for example, are planning to use FOQA data to cut aircraft maintenance costs by more closely monitoring engine conditions and fuel consumption.

The FOQA Demonstration Project

On July 11, 1995, FAA awarded a 2-year contract[25] to execute a FOQA demonstration project, referred to as DEMOPROJ by FAA, to Universal Technical Resource Services, Inc. (UTRS), of Cherry Hill, New Jersey. The contract stated that

> "The goal of DEMOPROJ is to facilitate the start-up of the FOQA initiative and to comprehensively assess the cost-benefits and safety enhancement effectiveness of an implemented FOQA program in which airlines voluntarily employ in-flight recorded data to routinely monitor their flight operations."

UTRS facilitated the establishment of collaborative partnerships between FAA, UTRS, and interested airlines. Airlines may participate in DEMOPROJ at one of three levels within the project, ranging from attending meetings and expressing interest to a full partnership with FAA. Level 3 participation

[25]The term of the contract was later revised to 3 years.

refers to the airlines that have not yet established an official FOQA program but attend meetings to learn about FOQA. At Level 2, the airlines already have their own equipment or will acquire equipment using airline funding, but they allow UTRS to monitor and document their program. Level 1 describes a full partnership in which equipment and software are provided through DEMOPROJ. Currently, 11 airlines are participating in DEMOPROJ. The airlines participating at Level 1 are United, US Airways, and Continental. All other participating airlines in DEMOPROJ are at Level 3: Alaska, America West, Delta, Northwest, Trans World, Southwest, Continental Express, and United Parcel Service.

The airline participants were selected on the basis of a number of characteristics, including financial stability, management commitment, resource commitment, fleet characteristics, fleet size, aircraft availability, and an approved implementation and operation plan. Additionally, airlines are required to sign nondisclosure and cooperation agreements that define the treatment of confidential and proprietary information, enumerate data access control and security provisions, and specify the responsibilities and contributions of each party. Participating airlines also had to secure agreements with their pilot associations for the collection and analysis of flight data. These airlines made the commitment to record and process FOQA data on all scheduled flights that are equipped with FAA-supplied equipment, participate in periodic project reviews, and allow UTRS to interview airline personnel during the project to document procedures, problems, issues, and solutions.

UTRS assisted airlines in determining the equipment best suited to their needs, acquiring the equipment, and delivering it for installation by the airlines. Hardware and software were selected from commercially available, off-the-shelf sources. As part of this effort, the contractor developed an Equipment Overview to facilitate the airlines' analysis and selection of available equipment.

UTRS also monitors and documents the airlines' FOQA demonstration programs' policies, procedures, usage, and effectiveness. The contractor is collecting and analyzing information on how each airline is implementing FOQA, including data processing and analysis; the retention of detail and trend data; the selection of flight data parameters; and the adjustment of threshold values, system effectiveness, technical problems, and resource information for establishing and maintaining a FOQA program. These findings are integrated and disseminated among participants throughout the study. UTRS is also collecting information about the projects' costs and

anticipated benefits. The contractor is determining how each airline transforms FOQA data into information and how this information is used in the airline's decision-making. UTRS holds periodic meetings for all partners to promote the sharing of information and lessons learned.

UTRS, with airlines' and pilot associations' involvement, is developing a FOQA advisory circular to provide information and guidance to airlines on how to design, implement, and maintain a FOQA program. This document is scheduled to be issued approximately 90 days after FAA issues its proposed rulemaking on enforcement policy in connection with FOQA. UTRS is also developing a cost-benefit analysis that will provide estimates of (1) the costs that an airline would incur when starting and maintaining a FOQA program and (2) potential savings. The cost-benefit study is scheduled to be completed in January 1998.

UTRS will issue a technical report and a set of FOQA guidelines in June 1998. The technical report will be an overall description of the technical effort to implement FOQA, summarizing the airlines' experiences with commercially available equipment and systems. The FOQA guidelines will synthesize the airlines' experiences in implementing FOQA with a view toward helping new airlines learn from the airlines that have implemented a FOQA program. The guidelines will include information on (1) designing a FOQA program; (2) the start-up and initial operation of a system; (3) the use of FOQA for trend analysis, knowledge building, and decision-making; and (4) critical success factors for implementing a FOQA program.

In fiscal years 1995 through 1997, according to the FAA FOQA program manager, FAA allocated $5.5 million for DEMOPROJ. The manager stated that, as of September 26, 1997, DEMOPROJ had expended $2.1 million, including $1.1 million for the purchase of hardware and software for the three Level 1 airline participants. FAA plans to pursue follow-on development focused on the acquisition and use of FOQA information by FAA for safety monitoring purposes.

U.S. Airlines With Active FOQA Programs

Currently, four U.S. airlines have active FOQA programs: United Airlines, US Airways, Continental Airlines, and Alaska Airlines. These airlines have equipped a number of their aircraft with QARS, from 7 aircraft at Alaska Airlines to 52 aircraft at United Airlines. The number of parameters continuously recorded on the QARS range from about 38 to over 300, depending on the airline and the type of aircraft.

United Airlines. United Airlines has the largest and longest-running FOQA program of any U.S. airline, begun in 1995. As of August 1997, United had 52 aircraft equipped with QARS and had collected FOQA data on over 25,000 flights. The aircraft currently equipped include Boeing 737-500s and 777s and Airbus 319s and 320s. United plans to equip over 120 aircraft by 1999, including all new aircraft currently on order. DEMOPROJ has funded the purchase of QARS to equip 15 Boeing 737-500s and additional data analysis packages and computer equipment to run on systems that United had already established. The remainder of the hardware and software was purchased by United, which has been tracking and correcting exceedance events for more than a year. United has identified and taken corrective action to reduce the incidence of a number of safety- and maintenance-related exceedances.

US Airways. US Airways has 23 QAR-equipped aircraft. Its program, begun in September 1996, has collected FOQA data on over 18,000 flights to date. Aircraft equipped include Boeing 737-400s and 767s. US Airways, however, characterizes its program as being in the data collection and trouble-shooting phase and just beginning the data analysis and trending phase. DEMOPROJ has funded the purchase of QARS to equip 15 Boeing 737-400s and a ground analysis system. Six additional 737-400s have been equipped with QARS paid for by a separate FAA program, the Structural Loads Program (see app. III). In addition to these aircraft, US Airways is in the process of purchasing QARS and equipping 12 Boeing 767s. Data from all QARS are being accessed by both programs. DEMOPROJ has also funded a trial program of a wireless ground datalink system with five specially equipped Boeing 757s.

Continental Airlines. Continental has equipped 15 Boeing 737-500s with QARS. In addition, Continental plans to equip with QARS all new aircraft on order. These include Boeing 737-500s, –600s, –700s, and –800s as well as a number of 757s. Begun in December 1996, Continental's program has analyzed the flight data from over 11,000 flights to date. According to the program manager, this program is in the data collection phase and will soon be making the transition to the data analysis and trending phase.

Alaska Airlines. Alaska Airlines has equipped six McDonnell Douglas MD-80s and one Boeing 737-400 with QARS. In addition, Alaska has equipped a flight simulator with equipment to record hundreds of flight parameters. Begun in July 1996, the program has analyzed the flight data from over 5,000 flights to date. Still in the early stages of the program,

Alaska plans to "go slow" and refine its program. Alaska's FOQA manager said that the airline may eventually equip every aircraft in its fleet.

Unlike United, US Airways, and Continental, which are Level 1 participants in DEMOPROJ, Alaska is a not yet a full partner in DEMOPROJ because it has only recently secured the required agreement with its pilot union on FOQA. The airline, however, has received six QARS and a ground analysis system from FAA's Structural Loads Program (see app. III). Alaska uses the equipment and analysis system for both the Structural Loads Program and FOQA.

U.S. and Foreign Airlines With FOQA or FOQA-TYPE Programs

Adria Airways
Aeroflot
Air Afrique
Air France
Air Inter
Air Liberte
Alaska Airlines
All Nippon Airways
Asiana Airlines
Balkan Airlines
Britannia
British Airways
British Midland
Cathay Pacific Airways
China Airlines
China Southern Airlines
China South West Airlines
Continental Airlines
Emirates
Ethiopian Airlines
EVA Airways
Garuda Indonesia
GB Airways
Gulf Air
Japan Airlines
Royal Dutch Airlines (KLM)
Kuwait Airways
Lufthansa
Qantas Airways
Saudia Arabian Airlines
Scandanavian Airline System (SAS)
Singapore Airlines
TAP Air Portugal
Thai Airways International
United Airlines
US Airways
Wideroe[26]

Source: GAO and The Flight Data Company, Ltd.

[26]The list may not be comprehensive.

FAA's Related Technical Programs

Aviation Performance Measuring System. In 1993, FAA contracted with the National Aeronautics and Space Administration (NASA) to establish and demonstrate the feasibility of developing an Aviation Performance Measuring System (APMS). The objective of the APMS effort is to develop tools and methodologies to allow large quantities of flight data to be processed in a highly automated manner to address questions relating to operational performance and safety. APMS is concerned with converting flight data into useful safety information in support of the national air transport system, airlines, and air crews. Although concerned with all aspects of flight operations, APMS primarily will develop an objective method for continuously evaluating air crews' technical performance in support of FOQA and the Advanced Qualification Program (discussed below).

Current FOQA programs focus on exceedances; APMS, however, will expand FOQA's scope by utilizing all flight data. The tools will facilitate multiple functions, including the acquisition of flight data, their storage in a database management system, the study of statistical characteristics and trends, the development of "data mining" techniques, and better methods of visualizing flight data. APMS will also investigate flight animation capabilities to assist flight crews in replaying and understanding exceedances. Finally, APMS will facilitate the sharing of data among databases, products, and interested parties. According to NASA officials, one of the most important components to be developed by APMS is a risk assessment tool to measure how much risk is associated with certain activities, for example, the riskiness of flights to/from certain airports.

After APMS began in 1993, the project documented the status of the technologies, systems, and software used by foreign airlines with FOQA programs. According to the NASA project manager, the project has conducted user needs studies at Alaska Airlines, United Airlines, and US Airways and has commitments to conduct user needs studies at America West, Trans World Airlines, Comair, and United Parcel Service. The APMS team is also building prototype systems at several airlines. Alaska Airlines is now in its third prototype APMS system. The project was scheduled to begin building the initial prototype system at United Airlines on November 1, 1997. Eventually the developed technology will be transferred to industry so that a relatively low-cost system will be commercially available. APMS management hopes to initiate the transfer of this technology to commercial vendors in 12 to 18 months.

To date, NASA has received $2.9 million in funding from FAA for the development of APMS. NASA contributed $300,000 to the project in fiscal year 1997. The extent of future NASA and FAA funding for further development and implementation of APMS has not yet been determined.

Structural Loads Program. As part of FAA's Aging Aircraft Research and Development Program, the Structural Loads Program is a cooperative FAA and NASA effort to collect information about the external loads to which airframe components are subjected during flight. The collected data will be used to develop and maintain an extensive database of transport aircraft usage to continuously validate and update flight and landing load airworthiness certification standards on the basis of actual measured usage. To date, the Structural Loads Program has equipped with QARS six MD-80s at Alaska Airlines and six Boeing 737-400s at US Airways. Data collected from these QARS are also being made available for FOQA analysis.

Advanced Qualification Program. FAA's Advanced Qualification Program (AQP) is an alternate method of qualifying, training, certifying, and ensuring the competency of flight crew members and other operations personnel subject to the training and evaluation requirements of Federal Aviation Regulation (FAR) parts 121 and 135. AQP's intent is to achieve the highest possible standards of individual and crew performance without undue increases in training costs. FOQA and APMS will be used to continuously evaluate air crews' technical skills and airlines' procedures and training in support of AQP. For example, FOQA data could be used to identify problems occurring during recurrent flight simulator training and to highlight training areas for increased emphasis.

Global Analysis and Information Network. The Global Analysis and Information Network (GAIN) is a concept being actively explored by the aviation community to facilitate the analysis, sharing, and dissemination of aviation safety information with a goal of achieving zero accidents. GAIN would have many information sources—FOQA information would be one of the most important. Proposed by FAA in May 1996, GAIN will function as a "significantly improved operational early warning capability that is sensitive enough to detect and alert the aviation community to existing and emerging problems." Information will be shared among airlines and manufacturers and at the different functional levels within organizations. Although GAIN is still in the conceptual phase, the aviation community and FAA are working to address the needs and concerns of prospective members as well as explore potential designs for a prototype system.

FAA's Voluntary Safety Reporting: Selected Programs

FAA has implemented a number of voluntary programs involving the self-reporting of safety-related information to enhance aviation safety. Although these programs involve the reporting of information by people instead of by automated systems, they are similar to FOQA in that they involve voluntary efforts to identify and correct potential safety problems. We have highlighted three such programs.

Aviation Safety Reporting Program. Established by FAA in 1975 and administered by NASA, the Aviation Safety Reporting Program (ASRP) promotes the voluntary reporting of problems into the Aviation Safety Reporting System (ASRS). Under 14 C.F.R. 91.25, FAA will not use reports submitted under the program in any enforcement action (except accidents or criminal offenses). Under FAA's policy, although a finding of violation may be made, no sanction will be imposed if (1) the violation was inadvertent and not deliberate, (2) the violation did not involve a criminal offense or an accident or an action that discloses a lack of qualification or competency, (3) the person filing the report has not been found in any prior FAA enforcement action to have committed a violation of federal aviation regulations or law within a period of 5 years prior to the occurrence, and (4) the report was filed within 10 days after the violation. AC 00-46D (Feb. 26, 1997), "Aviation Safety Reporting Program."[27]

Air Carrier Voluntary Disclosure Reporting Procedures. Initiated by FAA in 1990 for air carriers,[28] the Voluntary Disclosure Procedures encourage airlines to promptly disclose to FAA any instances of noncompliance with the requirements for maintenance, flight operations, and security. FAA initiated a policy of forgoing civil penalty actions if five conditions are met: (1) the certificate holder immediately notifies FAA of the apparent violation after detecting it and before the agency learns of it; (2) the apparent violation is inadvertent; (3) the apparent violation does not indicate a lack, or reasonable question, of the basic qualification of the certificate holder; (4) immediate action must have been taken, or begun, upon discovery to terminate the conduct that resulted in the apparent violation; and (5) the certificate holder must develop and implement a comprehensive solution satisfactory to the FAA. AC 120-56 (Jan. 23, 1992), "Air Carrier Voluntary Disclosure Reporting Procedures."

[27]Provisions concerning air traffic controllers involved in incidents reported under ASRS are addressed in FAA Order 7210.3.G, Facility Operations and Administration.

[28]According to an assistant chief counsel at FAA, the procedures have since been expanded to include production approval holders and repair stations.

Aviation Safety Action Programs. FAA has established several demonstration Aviation Safety Action Programs (ASAP), including the USAir Altitude Awareness Program, the Alaska Airlines Altitude Awareness Program, and the American Airlines Safety Action Program.[29] These programs established incentives to encourage the employees of the air carriers that are participating in the programs to disclose information and identify possible violations of the Federal Aviation Regulations without fear of punitive legal enforcement sanctions. FAA has recently expanded the use of ASAP through the implementation of a 2-year demonstration program. Under this program, apparent violations will normally be addressed with administrative action if the apparent violations do not involve (1) deliberate misconduct, (2) a substantial disregard for safety and security, (3) criminal conduct, or (4) conduct that demonstrates or raises a lack of qualifications. For apparent violations not excluded under an ASAP, neither administrative action nor punitive legal enforcement actions will be taken against an individual unless there is sufficient evidence of the violation other than the individual's safety-related report. AC 120-66 (Jan. 8, 1997), "Aviation Safety Action Programs (ASAP)."

[29]The Altitude Awareness programs at USAir and Alaska Airlines were joint programs with the Air Line Pilots Association and FAA to eliminate altitude deviations. USAir's program, in operation from October 1990 through February 1992, and Alaska Airlines' program, in operation from August 1994 through February 1995, encouraged flight crews to report altitude problems so that corrective action could be taken. The American Airlines Safety Action Program is a joint program with the Allied Pilots Association (American's pilot union) and FAA. Begun in June 1994, the program encourages pilots to report all types of potential safety problems.

Discovery-Related Court Actions

Airline officials and pilot unions' representatives are concerned about the use of discovery in civil litigation to reveal voluntarily collected safety information. In two recent cases, the courts have sought to find a balance between the airlines' desire to protect such information and the plaintiffs' right to a fair trial. In one case, the documents were required to be produced, but under a protective order. In the other case, the court recognized a new qualified privilege.

In 1995, the United States District Court, District of South Carolina, Columbia Division, rejected USAir, Inc.'s[30] argument that certain safety data were protected under the self-critical evaluation privilege. Court Order of Oct. 26, 1995, In re Air Crash at Charlotte, North Carolina, on July 2, 1994, MDL Docket No. 1041 (D.S.C. 1995). This privilege, when recognized, protects documents that reflect self-analysis.

The district court noted that the self-critical evaluation privilege is a privilege of recent origin and one that is narrowly applied even in those jurisdictions where it is recognized. The court described the privilege by citing to Dowling v. American Hawaii Cruises, Inc., 971 F.2d 423, 425-426 (9th Cir. 1992), which explained:

> "[O]ther courts have generally required that the party asserting the privilege demonstrate that the material to be protected satisfies at least three criteria: first, the information must result from a critical self-analysis undertaken by the party seeking protection; second, the public must have a strong interest in preserving the free flow of the type of information sought; finally, the information must be of the type whose flow would be curtailed if discovery were allowed. . . .To these requirements should be added the general proviso that no document will be accorded a privilege unless it was prepared with the expectation that it would be kept confidential, and has in fact been kept confidential."

The court found that the safety documents did not meet the criteria for the privilege. According to the court, the most significant stumbling block for the airline was meeting the third criterion—that the flow of the information would be curtailed if discovery was allowed. Specifically, the court found that the airline industry is highly competitive and tightly regulated and that airlines have a keen interest in advancing and promoting safety as well as services. Thus, the court reasoned that the airlines were likely to conduct internal audits. The court reasoned that while the disclosure of such audits to competitors would deter their use in the future, disclosure for limited use in litigation is unlikely to have such an impact.

[30]USAir changed its name to US Airways on Feb. 27, 1997.

Subsequently, the court limited the possible uses of the documents it ordered to be produced. Specifically, the court ordered:

"... plaintiff and their counsel shall be prohibited from disclosing, disseminating or communicating in any manner to any person or entity not involved in this litigation any portion of the information contained in those documents. . . . Plaintiff and their counsel shall be further precluded from utilizing these documents or the information contained in them for any purpose other than for this multidistrict litigation.

"In furtherance of this order, plaintiffs' counsel shall insure that each person who is to be given access to the referenced documents, including plaintiff and their attorneys, shall first sign a document acknowledging that they are aware of and will comply with this order. Plaintiffs' counsel shall maintain a list of those persons which shall be provided to USAir's attorney upon request, subject to protection upon application to this court for good cause shown." Court Order of Nov. 14, 1995, In Re: Air Crash at Charlotte, North Carolina, on July 2, 1994, MDL Docket No. 1041 (D.S.C. 1995).

In October 1996, the Supreme Court let stand the district court order rejecting the airline's assertion of a self-critical evaluation privilege. 65 U.S.L.W. 3221 (Oct. 8, 1996).

Recently, in another case involving documents prepared by American Airlines' employees collected under the American Airlines Safety Action Program, the United States District Court, Southern District of Florida, on a motion for reconsideration, also rejected the airline's self-critical analysis privilege claim. However, in this case the court recognized a new qualified privilege to protect these documents. In re Air Crash Near Cali, Colombia, on Dec. 20, 1995, 959 F. Supp. 1529 (S.D. Fla. 1997).

With respect to the self-critical analysis privilege, the court stated that "the touchstone of a self-critical analysis is that it is an 'in house' review undertaken primarily, if not exclusively, for the purpose of internal quality control." In this case, the court rejected the application of the privilege, finding the following:

"Even assuming that the materials prepared by American's pilots in conjunction with the ASAP program may be of a type whose creation might be curtailed if discovery is allowed, these materials were prepared for dissemination to representatives of entities unaffiliated with American (a federal regulatory agency and a union)."

The court, however, recognized a new, qualified common law privilege for the ASAP materials. In recognizing a new privilege, the court considered the

principles for evaluating claims of federal common law privileges recently articulated in the Supreme Court case, Jaffee v. Redmond, __ U.S. __, 116 S. Ct. 1923 (1996): (1) the "private interest" involved—in other words whether the dissemination of the information would chill the frank and complete disclosure of fact; (2) the "public interests" furthered by the proposed privilege; (3) the "likely evidentiary benefit that would result from the denial of the privilege;" and (4) the extent to which the privilege has been recognized by state courts and legislatures.[31]

The court found that American had met its burden of proving that a qualified "ASAP privilege" is appropriate. Specifically, the court stated as follows:

"The ASAP materials in dispute . . . were prepared voluntarily, in confidence and for use in a discrete, limited context in cooperation with the FAA and the pilot's union. There is a genuine risk of meaningful and irreparable chill from the compelled disclosure of ASAP materials in connection with the pending litigation."

The court specified that the privilege should be qualified. Accordingly, the plaintiffs could overcome the privilege with a persuasive showing of need and hardship. The plaintiffs did not make such a showing in the case.

[31]The court recognized a psychotherapist-patient privilege in this case.

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